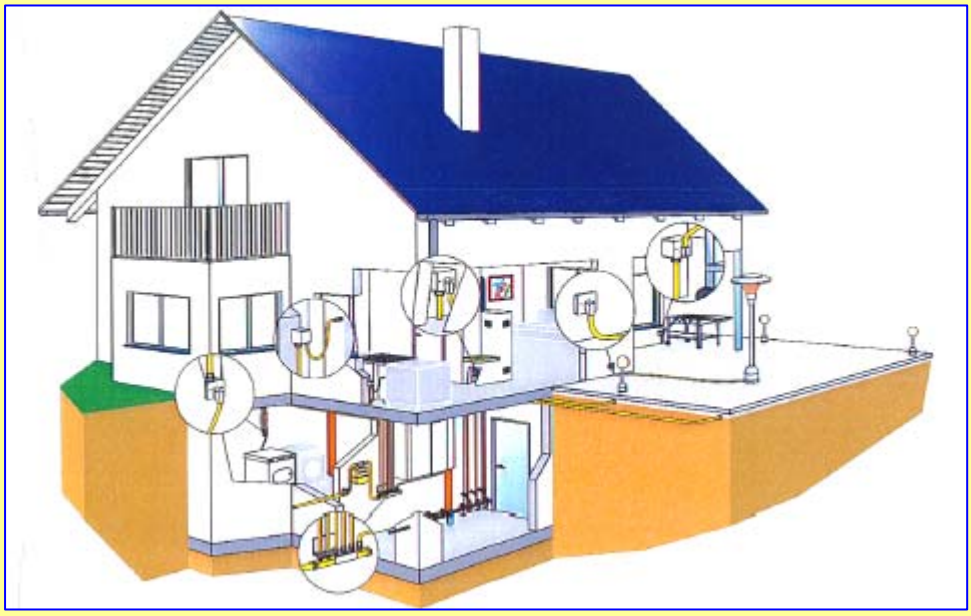
BOAGAZ

Corrugated Stainless Steel Pliable Tubing System for Gas Installations in Buildings



Design and Installation Manual Issue: UK

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User Warnings

All gas installation work shall be carried out by a business or self employed operative who is a member of a class of persons approved by the Health and Safety Executive (HSE) Current registration body is Gas Safe Register

Acceptable certificates of competence are those issued under the: Nationally Accredited Certification Scheme (ACS) for individual gas fitting operatives; or Scottish/National Vocational Qualifications (NVQ) that have been aligned to ACS in matters of gas safety.

Only those components provided or specified by BOA as part of the approved Corrugated Stainless Steel Pliable Tube (CSSPT) system are to be used in the installation. The BOAGAZ® system of CSSPT and fittings is not compatible with other manufacturer's flexible gas piping systems. It is important to note that any mixing of products may result in failure of the system with potentially serious consequences.

All gas appliances and other gas fittings must be installed with due regard to the manufacturer's installation instructions, the Gas Safety (Installation and Use) Regulations 1998 and the relevant requirements of the Building Regulations and British Standards.

Improper installation methods or procedures could lead to accidents such as explosions, fires, gas poisoning, asphyxiation, etc. The BOAGAZ® CSSPT system shall be installed with strict adherence to this guide as well as local building regulation. All installed systems must pass installation inspections by the authorized local building official prior to being placed in service. BOA AG shall have no responsibility for any misinterpretation of the information contained in this guide or any improper installation or repair work or other deviation from procedures recommended in this manual, whether pursuant to local building regulation or engineering specifications or otherwise.

Although the BOAGAZ® CSSPT system provides significant advantages over more rigid gas delivery systems, its wall dimensions may make it more likely than steel tubing to be punctured by a nail or other sharp objects, or damaged by other extraordinary forces such as a lightning strike, depending on the circumstances. The user must ensure that the system is properly bonded and grounded.

No naked flame shall to be used in the vicinity of any part of the BOAGAZ® CSSPT system.

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1 Scope of Design and Installation Guide

The BOAGAZ® stainless steel corrugated pliable tubing (CSSPT) system can be used for installations of natural gas and LPG.. The system is approved under the BS Kitemark number KM 539844.

The approval was made in accordance with BS EN 15266:2007 *Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0.5bar*

The BOAGAZ® stainless steel pliable corrugated pliable tubing (CSSPT) system can be used for domestic and industrial and commercial (I&C) applications.

1.1 Supporting Documents

BS EN 15266:2007: *Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0.5 bar*

BS 5482: Code *of practice for domestic butane and propane-gas burning installations Part 1: Installations at permanent dwellings, residential park homes and commercial premises, with installation tubing sizes not exceeding* DA/25 *for steel and* DA/28 *for corrugated stainless steel or copper.*

BS 6891:2005 + A2:2008: *Installation of low pressure gas tubing of up to 25 mm (R1 ¼") in domestic premises (2nd family gas).*

IGE/UP/1/New Edition 2 2003: *Strength testing, tightness testing of industrial and commercial gas installations*

IGE/UP/1A/New Edition 2 2003*: Strength testing, tightness testing and direct purging of small, low pressure industrial and commercial Natural Gas Applications*

IGE/UP/1B – Edition 2: *Tightness testing and purging of domestic sized Natural Gas Installations*

IGE/UP/2 – Edition 2-2008: *Utilization Procedures - Gas Installation Tubing, Boosters and Compressors on Industrial and Commercial Premises.*

BS EN 1775:2007: *Gas supply. Gas tubing for buildings. Maximum operating pressure less than or equal to 5 bar. Functional recommendations.*

BS 476: *Fire resistance of building materials / elements.*

BS 7671:2008 *Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition BS 7671***:** *Requirements for electrical installations*

BS 6004:2000 : *Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring*

BS 6400-2:2006 : *Specification for installation, exchange, relocation and removal of gas meters with a maximum capacity not exceeding 6 m^3/h. Medium pressure (2nd family gases)*

BS 6231:2006: *Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and control gear wiring*

BS 6007:2006 *: Electric cables. Single core unsheathed heat resisting cables for voltages up to and including 450/750 V, for internal wiring*

1.2 Definitions

Bending radius
The radius measured to the centre line of the BOAGAZ® CSSPT

Minimum bending radius
Minimum radius at which the BOAGAZ® CSSPT

Recommended bending radius
Recommended radius above which the BOAGAZ® CSSPT is designed to operate with no pressure drop attributable to the bend.

Tightening Torque
Maximum allowable nut tightening torques for connecting fittings to BOAGAZ® CSSPT

Mechanical joint (EN1775)
Metal-to-metal connection within which gas tightness is achieved by threaded compression of the two component parts and possibly a sealing/jointing compound.

Mechanical coupling (EN 1775)

1.3 Competence and system conformity

1.3.1 Competence

All gas installation work shall be carried out by a business or self employed operative who is a member of a class of persons approved by the Health and Safety Executive (HSE).. Currently Gas Safe Register is the Registration Body.

Acceptable certificates of competence are those issued under the: Nationally Accredited Certification Scheme (ACS) for individual gas fitting operatives; or Scottish/National Vocational Qualifications (NVQ) that have been aligned to ACS in matters of gas safety.

1.3.2 System conformity

Only those components provided or specified by BOA as part of the approved piping system are to be used in the installation. The BOAGAZ® CSSPT system of piping and fittings is not compatible with other manufacturer's flexible gas piping systems. It is important to note that any mixing of products may result in failure of the system with potentially serious consequences.

All gas appliances and other gas fittings must be installed with due regard to the manufacturer's installation instructions, the Gas Safety (Installation and Use) Regulations 1998 and the relevant requirements of the Building Regulations and British Standards.

2 Description of the BOAGAZ® System and System Components

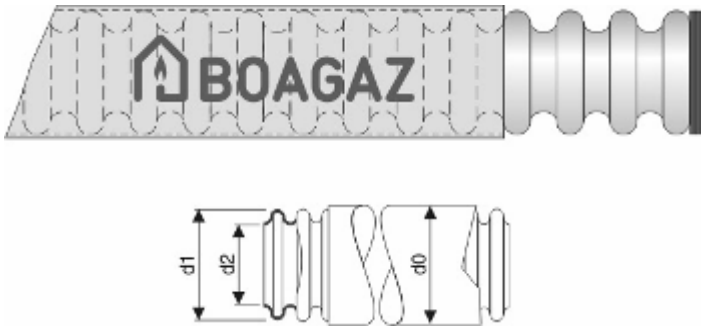
The BOAGAZ® CSSPT system provides the installer with both flexibility, in terms of positioning gas supply piping, the prospect of significantly reduced installation time and increased safety associated with using fewer joints and couplings.

The components of the BOAGAZ® CSSPT system together with dimensions are detailed below.

2.1 CSS tubing dimensions

BOAGAZ® CSSPT for *conveying gas*

Material:
Tubing: Stainless Steel 1.4404
Cover: PE



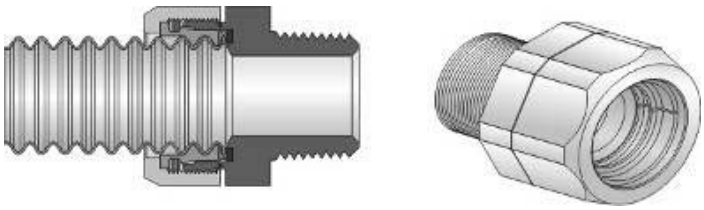
CSSP tubing size in mm	DN 15	DN 20	DN 25	DN 32
Outside diameter with covering d0	19.7	25.9	31.8	39.8
Outside diameter without covering d1	18.7	24.9	30.8	38.8
Minimum inner diameter d2	14.8	19.7	24.6	31.9
Material thickness	0.25	0.25	0.25	0.25
Lengths in cardbord box	15 / 30 m	15 / 30 m	15 / 30 m	15 / 30 m
Lengths on drums	75 m	75 m	75 m	45 m

Table 1: BOAGAZ® CSSPT dimensions

2.2 BOAGAZ® Male mechanical joints

Male mechanical joint fittings connect the BOAGAZ® CSSPT to a manifold or gas outlet with female thread.

Material:
Body, Nut, Retainer Brass CW603N or CW612N
Gasket: Elastomer (EN 549)



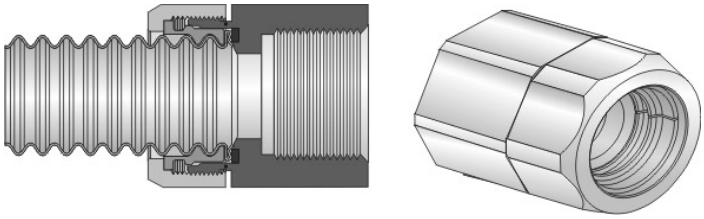
Dimensions	Item n°	Weight in kg
DN 15 x R ½	M-0032963	0.13
DN 20 x R ½	M-0036632	0.21
DN 20 x R ¾	M-0032964	0.22
DN 20 x R 1 ¼	M-0035630	0.23
DN 25 x R ¾	M-0036633	0.29
DN 25 x R 1	M-0032965	0.30
DN 25 x R 1 ¼	M-0035631	0.32
DN 32 x R 1 ¼	M-0032966	0.59

Table 2: Thread sizes and weights of BOAGAZ® male fittings

2.3 BOAGAZ® Female mechanical joints

Female mechanical joint fittings connect the BOAGAZ® CSSPT to valves or fittings with taper male threads.

Material:
Body, Nut, Retainer: Brass CW603N or CW612N
Gasket: Elastomer (EN 549



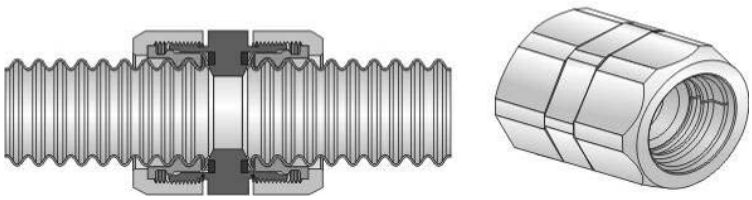
Dimensions: Dimension x taper female thread EN10226-1	Item n°	Weight in kg
DN 15 x Rp ½	M-0031860	0.13
DN 20 x Rp ¾	M-0031862	0.27
DN 25 x Rp ¾	M-0031864	0.33
DN 32 x Rp 1	M-0031865	0.35

Table 3: Thread sizes and weights of BOAGAZ® female fittings

2.4 BOAGAZ® Couplings

Mechanical couplings join BOAGAZ® CSSPT of the same size.

Material:
Body, Nut, Retainer Brass CW 603N or CW612N
Gasket: Elastomer (EN 549)



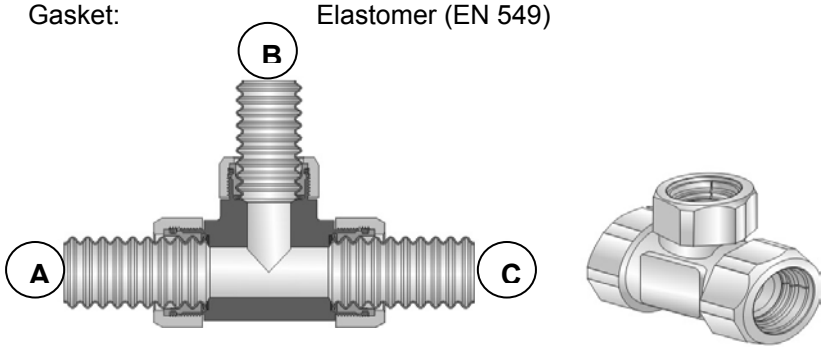
Dimensions	Item n°	Weight in kg
DN 15 (½“)	M-0031867	0.15
DN 20 (¾“)	M-0031868	0.25
DN 25 (1“)	M-0031869	0.37
DN 32 (1 ¼“)	M-0031870	0.76

Table 4: Size and weights of BOAGAZ® *couplings*

2.5 BOAGAZ® Mechanical Tees

Mechanical Tees join BOAGAZ® CSSPT of same or different sizes.

Material:
Body, Nut, Retainer Brass CW603N or CW612N
Gasket: Elastomer (EN 549)

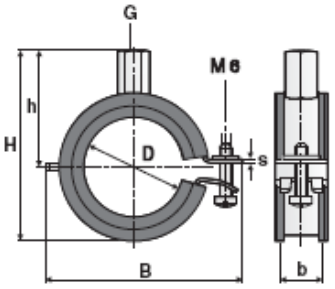


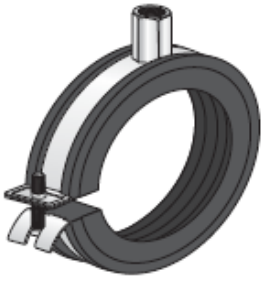
Sizes of Tees Dimensions (A x B x C)	Item n°	Weight in kg
DN15 x DN15 x DN15	M-0031873	0.57
DN20 x DN15 x DN20	M-0031876	0.63
DN20 x DN15 x DN15	M-0031877	0.60
DN20 x DN20 x DN20	M-0031878	0.65
DN25 x DN25 x DN25	M-0031879	1.00
DN25 x DN15 x DN25	M-0031880	1.02
DN25 x DN20 x DN25	M-0031881	1.00
DN25 x DN20 x DN20	M-0031882	1.04
DN25 x DN15 x DN20	M-0031883	1.04
DN32 x DN25 x DN20	M-0036369	1.10
DN32 x DN20 x DN20	M-0036370	1.10
DN32 x DN32 x DN32	M-0031884	1.15

Table 5: Mechanical tee sizes and weights

2.6 Pipe Supports with quick-locking system

For the quick and reliable fix of the BOAGAZ® CSSPT



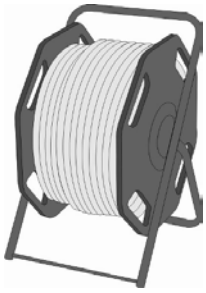


G	D			B	H	h	b x s (mm)
	mm	(“)	(DN)	(mm)	(mm)	(mm)	
M8/10	20 - 23	½	15	54	47	31	20 x 1.25
M8/10	25 - 28	¾	20	59	52	34	20 x 1.25
M8/10	32 – 35	1	25	65	59	38	20 x 1.25
M8/10	40 – 43	1¼	32	74	68	42	20 x 1.25

Table 6: Pipe support dimensions

2.7 Spool with Caddy

Helps to transport and to unroll the BOAGAZ® CSSPT from the spool



Description	Item n°
PLT Plastic spool	M-0032970
Caddy for PLT spool	M-0032969

Table 7: BOAGAZ® Spool with caddy

2.8 Tubing cutter

Special tool to cut BOAGAZ® CSSPT

Description/ Size	Item n°
BOAGAZ® Cutter for DN15 – DN20	M-0029999
BOAGAZ® Cutter for DN20 – DN32	M-0030000

Table 8: BOAGAZ® Tubing cutter

2.9 Stripper knife

Designed to remove the PE-cover from the BOAGAZ® CSSPT

Dimension	Item n°
Stripper knife DN15 – DN32	M-0030006

Table 9: BOAGAZ® Stripper knife

3 Planning and sizing

3.1 General

When designing an installation, the sizes of all installation piping shall be determined from the maximum gas rate of the appliances to be connected. Allowance can be made for the possibility of future extensions, especially if the piping is to be buried.

For natural gas, the pressure at the meter outlet should be 21 mbar and the pressure drop between the outlet of the meter and the points to be connected shall not exceed 1 mbar at maximum flow conditions. Low pressure 3rd family gas supplies should be regulated at 28 mbar (butane) or 37 mbar (propane), with a pressure drop not exceeding 2.5 mbar.

See below for the natural gas discharge rates through straight horizontal BOAGAZ® CSSPT with a 1mbar differential pressure between the ends.
Discharge rates for straight horizontal BOAGAZ® CSSPT
Medium: Natural gas

Pressure drop: 1 mbar
Inlet pressure: 21 mbar
Specific gravity: 0.6

Length	Discharge [m^3/h]			
[m]	DN15	DN20	DN25	DN32
1	3.9	7.7		
2	2.8	5.6	10.3	
5	1.8	3.6	6.5	11.7
7	1.5	3.1	5.5	10.0
10	1.2	2.6	4.5	8.4
20	0.9	1.9	3.2	6.1
40	0.5	1.4	2.2	4.4
50		1.2	2.0	3.9
100			1.4	2.8

Table 10: Discharge in a straight horizontal BOAGAZ® CSSPT with a 1mbar differential pressure between the ends for gas of specific gravity 0.6 (air = 1)

3.1.1 Equivalent tubing lengths

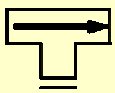
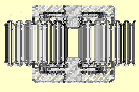
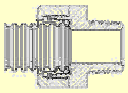
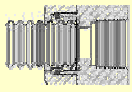
		Bend	Tee			Coupling	Adapter		Connection
									
		90°	Through Flow	Diverted Flow	Two directional flow	Coupling	Male Thread	Female Thread	Appliance Connection
Dimension	DN15	0.15 m	0.16 m	0.64 m	0.34 m	0.12 m	0.27 m	0.21 m	0.30 m
	DN20	0.22 m	0.14 m	0.70 m	0.36 m	0.08 m	0.23 m	0.22 m	0.37 m
	DN25	0.24 m	0.11 m	0.87 m	0.44 m	0.03 m	0.19 m	0.27 m	0.55 m
	DN32	0.30 m	0.12 m	0.94 m	0.53 m	0.03 m	0.19 m	0.30 m	0.62 m

Table 11: Equivalent tubing lengths for fittings and bends for 1 mbar differential pressure.

3.2 Sizing gas supplies

In order to determine the size of the BOAGAZ® CSSPT required for a specific natural gas application, the recommended approach is to allow for a 1mbar maximum pressure drop between the meter outlet and the inlets of appliances to be supplied. The BOAGAZ® CSSPT size to be used should be such that each appliance can operate satisfactorily at the same time at their maximum gas rate.

Figure 1 represents an example of the lengths of the supply tubing together with the appliance gas rates involved (Table 12). Tubing has been sized using Table 10 and the results presented in Table 13.

Due consideration should be given to the pressure loss permitted in each section of the application e.g. the drop in pressure between A and H should not be greater than 1mbar.

Each of the four elements of section A to H (A-B, B-D, D-F and F-H) carries a different gas rate and needs to be sized separately. With a total pressure drop permitted of 1mbar, each sub-section should carry a drop in pressure of no more than 0.25mbar. When calculating pressure drop using the data in Table 10, the length of tubing and also the number of tees and elbows needs to be taken into account (Table 11).

For the example given, each element is considered to be straight and horizontal.

Between elements D and F; the length of this section is 1.25m and needs to carry gas at a rate of 1.5m^3/h. It should have a pressure drop of no more than 0.25mbar. A pressure loss of 0.25mbar in a length of tubing 1.25m is equal to one of (4x0.25) = 1mbar in a length of (4x1.25m) = 5m.

In Table 10, the row corresponding to a length of 5m and aiming for a discharge rate of 1.5m^3/h, DN15 gives 1.8m^3/h and DN20 gives 3.6m^3/h.

In other words, the DN15 tubing gives sufficient flow rate of gas and DN20 diameter tubing is not required unless further appliances will be added or upgraded in future.

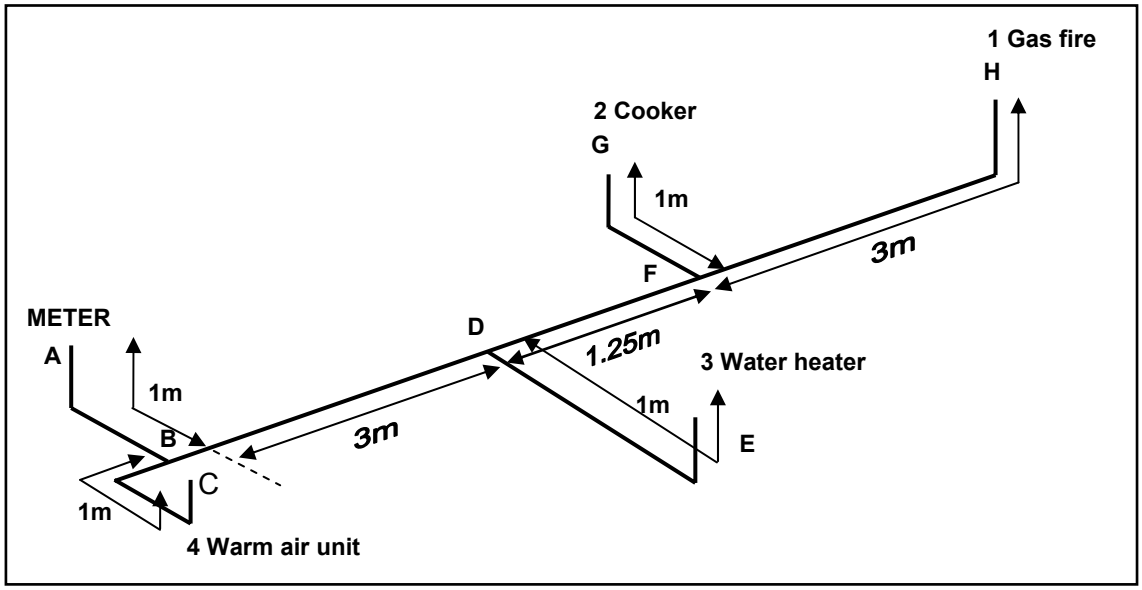


Figure 1: Example of a tube sizing calculation

Appliance	Gas Rate (typical) m^3/h	Key in figure 1	Total gas flow rate m^3/h
Warm air unit	1.0	4	5.0
Multi-point water heater	2.5	3	
Cooker	1.0	2	
Gas fire	0.5	1	
Central heating boiler	1.5	n/a	
Combination boiler	2.5	n/a	

Table 12: Appliances gas rates

Pipe section	Gas rate m^3/h	Pipe length m	Equivalent length fitting [a]		Total length m	Tube diameter mm
			type and number	equivalent length, m		
A-B	5	1	one bend	0.22	1.22	20
B-C	1	1	two bends one tee	0.15 (2x) 0.34	1.64	15
B-D	4	3	one tee	0.36	3.36	20
D-E	2.5	1	one bend one tee	0.15 0.64	1.79	15
D-F	1.5	1.25	one tee	0.16	1.41	15
F-G	1	1	one bend one tee	0.15 0.64	1.79	15
F-H	0.5	3	one bend one tee	0.15 0.16	3.31	15

a) Most appliances have horizontal connections, so in practice an additional bend is required at each point
b) Note that losses through tees have to be considered in each branch

Table 13: Tube sizing results

4 Safety precautions

4.1 General

In advance of the installation process, a risk assessment should be conducted to ensure the level of risk during tubing installation is minimised as far as is reasonably practicable.

For example, installers need to consider the risk of persons restoring the gas supply at the primary meter should they leave the general location where the work is in progress.

While installation work is in progress, care shall be taken to prevent the ingress of dirt, water, etc., into installation tubes. Such ingress could adversely affect the flow characteristics within the tubing and even block flow altogether (i.e. appliance orifice).

Where work is in progress on tubing already connected to a meter, either

a) the meter shall be disconnected temporarily and both the open ends of the tubing sealed and dust caps fitted to the meter; or

b) all open ends of the BOAGAZ® tubing shall be plugged, capped or terminated with a self-sealing appliance connector conforming to BS 669: Part 1 or BS 669: Part 2 as appropriate, before the work is left unattended.

Following the completion of work, open ends of all BOAGAZ® tubing shall be plugged, capped or terminated.

When running BOAGAZ® tubing in intermediate floors within dwellings, care should be taken to note the position of electrical cables, junction boxes and associated equipment, so that accidental damage or injury is prevented when introducing the tubing.

Similarly, BOAGAZ® tubing location should be marked so that re-fixing floors using nails or screws can be done safely.

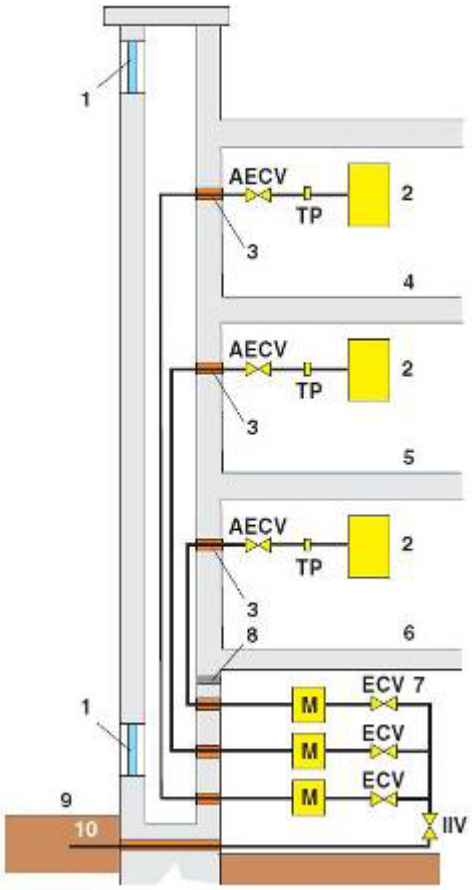
4.2 Fire protection

In buildings containing flats and/or maisonettes, BOAGAZ® installations shall be fire stopped as BOAGAZ® tubing passes from one floor to another unless they are installed in their own fire protected shaft that is ventilated top and bottom to outside atmosphere (see Figures 2 and 3).

Fire stopping material should be tested in accordance with BS 476 and be able to resist fire for periods that are in line with that required for the structure (load bearing capacity, integrity and insulation).

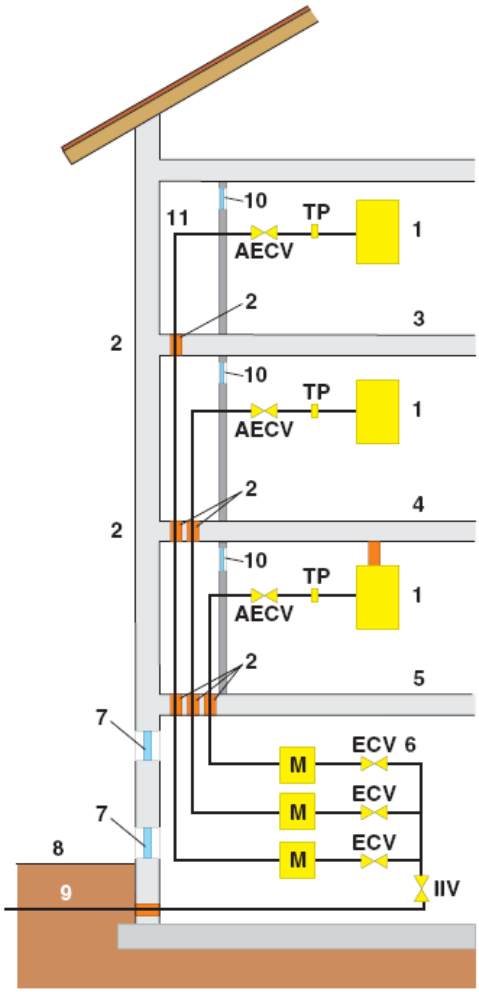
For BOAGAZ® tubing passing through ducts, the normal minimum period of fire resistance is 30min for buildings of not more than three storeys.

BOAGAZ® tubing within sleeves must not adversely affect the fire resistance of the building.



1 – Ventilation	9 – Ground level
2 – Appliance	10 – Gas service
3 – Fire stop	ECV – Emergency control valve
4 – Flat 3	AECV – Additional emergency control valve
5 – Flat 2	IIV – Inlet isolation valve
6 – Flat 1	M – Gas meter
7 – Meter room	TP – Test point
8 – Meter room ventilation	

Figure 2: Elements of a typical installation in multi-storey buildings containing flats or maisonettes – installation via a ventilated duct



1 – Appliance	9 – Gas service
2 – Fire stop	10 – Vent
3 – Flat 3	11 – Enclosure
4 – Flat 2	ECV – Emergency control valve
5 – Flat 1	AECV – Additional emergency control valve
6 – Meter room	IIV – Inlet isolation valve
7 – Meter room ventilation	M – Gas meter
8 – Ground level	TP – Test point

Figure 3: Elements of typical installation tubing in multi-storey buildings containing flats or maisonettes installation via a ventilated enclosed area

5 Installation Practice

Best practice (see BS 6891:2005) dictates that the BOAGAZ® CSSPT shall either be physically protected or else positioned within a property in a location where it is not prone to being mechanically damaged.

Similarly, the bore of the BOAGAZ® tubing shall not be affected by kinking, burring, foreign material within the tubing or by any other means.

Additionally, all system hardware should be stored in its original packaging prior to installation and kept in a dry location. Gas tubing should not be left outside prior to installation.

The BOAGAZ® tubing shall be of adequate length and capacity.

BOAGAZ® tubing exposed to extreme low temperature should be allowed to warm up to room temperature.

BOAGAZ® tubing may be routed through concrete floors or walls, provided it is passed through previously embedded conduit. BOAGAZ® tubing shall not be buried directly underground.

Carefully unwind and route the BOAGAZ® tubing from the reel to the required location, making certain not to kink, tangle or apply excessive force.

BOAGAZ® tubing ends must be temporarily capped or taped closed prior to installation to prevent contamination from foreign material.

When installing BOAGAZ®-tubing, avoid sharp bends, stretching, kinking, twisting or contacting sharp objects. The tubing shall be replaced if damage occurs.

Make continuous runs wherever possible.

5.1 Minimum bend radii

Regardless of the condition, large, smooth radius bends are preferred in order to reduce pressure loss. Avoid repeated bending during installation.

Tubing size DN	Recommended bend radius R (mm)	ISO 10380*
DN15	85	25
DN20	100	30
DN25	125	45
DN32	150	60

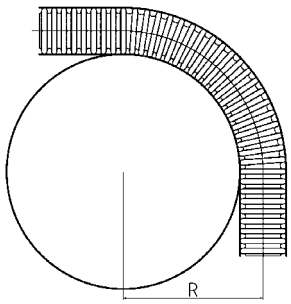


Table 14: Recommended installed bend radii (ISO 10380/EN 15266)

* according to EN ISO 10380:2003, Table 2, Type 3

5.2 Fitting Assembly

The nut should be tightened until it bottoms out on the body. The tightening torque should not exceed the values listed in the following table.

Tubing size	Maximum tightening torque Nm
DN15	68
DN20	163
DN25	217
DN32	271

Table 15: Maximum tightening torques for BOAGAZ® fittings

5.3 Sleeves

BOAGAZ® tubing passing through a solid wall or a floor needs to be sleeved. The coating or cover sleeve shall be made of a material capable of containing gas such as steel, polyethylene (PE) or polyvinyl chloride (PVC).

A sleeve is required to pass through the full width of a wall or the full thickness of the floor and must not adversely affect the fire resistance of the building.

The annular space between the BOAGAZ® tubing and the sleeve needs to be sealed to the tubing at one end with flexible fire resistant compound. In the event of a sleeve passing through an exterior wall, the seal needs to be on the inside of the wall.

The sleeve should be such that the BOAGAZ® tubing can be inserted satisfactorily into it and be of sufficient diameter to enable effective sealing between the tubing and the sleeve.

Mechanical joints should not be located within a sleeve.

The outside of the sleeve shall be secured and sealed at each end to the structure of the building with a suitable building material, e.g. cement mortar.

5.4 Tubing in ducts

5.4.1 Installation in ventilated ducts

Vertical or horizontal ducts containing BOAGAZ® CSSPT are required to be ventilated in order that any minor gas leakage within the duct, which is leakage that would not be detected by the normal gas tightness testing methods, does not cause the atmosphere within the duct to become unsafe.

Ventilation guidance is provided in Table 16 for different duct sizes.

Ducts with a small cross-sectional area and volume (less than 0.01m^2 with a total volume less than 0.1m^3) are considered to be sufficiently ventilated by adventitious openings.

Cross-sectional area of duct m^2	**Minimum free area of each opening m^2**
Not exceeding 0.01	0
0.01 and not exceeding 0.05	Cross sectional area of duct
0.05 and not exceeding 7.5	0.05
Exceeding 7.5	1/150 of the cross sectional area of the duct

Table 16: Free area of ventilation openings

5.4.2 Installation in unventilated ducts

BOAGAZ® tubing must not be installed in an unventilated duct or void although tubing may be continuously sleeved to allow it to pass through such a duct or void safely.

BOAGAZ® tubing must not be installed in a cavity wall; neither shall it pass through a cavity wall except by the shortest possible route and even then it must be sleeved (see 5.3).

5.5 Main equipotential bonding

All domestic gas installations shall have main equipotential bonding of the gas installation conforming to BS 7671.

Main equipotential bonding shall be connected: -

a) on the customer's side of the meter
b) as close as practicable to the meter before any branch in the installation tubing
c) in a position where it is accessible, can be visually observed, and fitted with a warning label stating 'Safety electrical connection. Do not remove.
d) by a mechanically and electrically sound connection which is not subject to corrosion

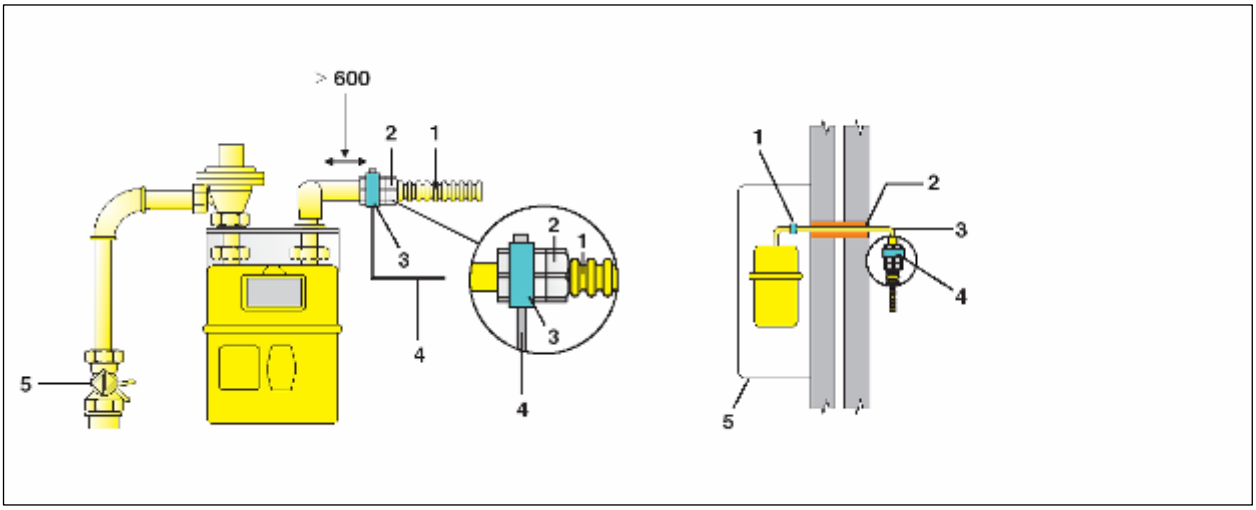
Main equipotential bonding of the gas installation tubing should be made using cable with minimum cross-sectional area of 10mm^2 cable with green and yellow insulation, construction reference 6419X conforming to BS 6004.

For internal meters, the bonding should be within 600mm of the meter outlet in order to allow for inspection/verification.

For meters in outside meter boxes/compartments, the bonding connection should be preferably inside the building and as near as practical to the point of entry of the installation tubing into the building.

Alternatively, the connection may be made within the box/compartment, but it is essential that the bonding cable does not interfere with the integrity of the box/compartment and the sealing of any sleeve (see Figure 4).

When relocating a meter, an existing main equipotential bond may be satisfactory as found, or it may need to be either lengthened or shortened or, in some cases, completely re-run. The bonding connection is satisfactory if the conditions a) to d) above are met.

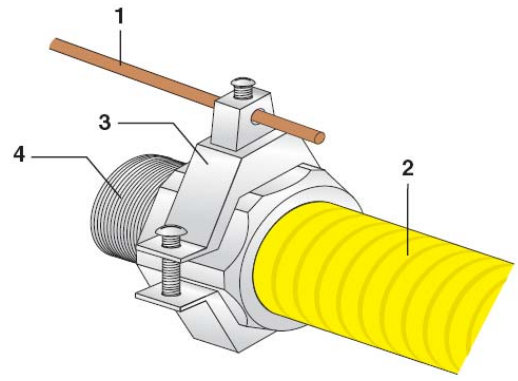


a) internal meter installation

b) meter installation in external box/compartment

1 BOAGAZ® tubing	1 Bonding connection (non-preferred position)
2 Fitting	2 Tubing sleeve (sealed)
3 Bonding connection	3 BOAGAZ® tubing
4 Green-yellow cable to consumer earth terminal	4 Bonding connection (preferred position)
5 ECV = Emergency Control Valve	5 Box/compartment

Figure 4: Main equipotential bonding



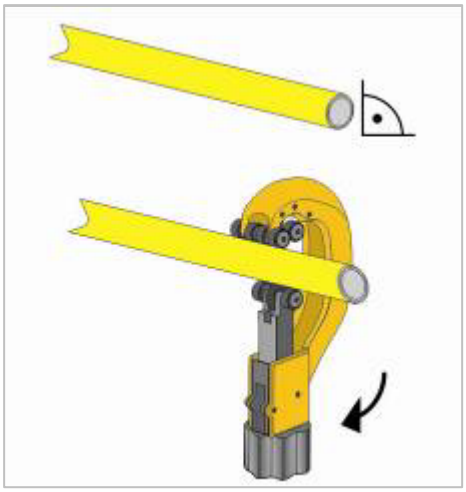
1 Bonding wire	3 Bonding connection
2 BOAGAZ® tubing	4 BOAGAZ® Fitting

Figure 5: Main equipotential bonding connection - detail

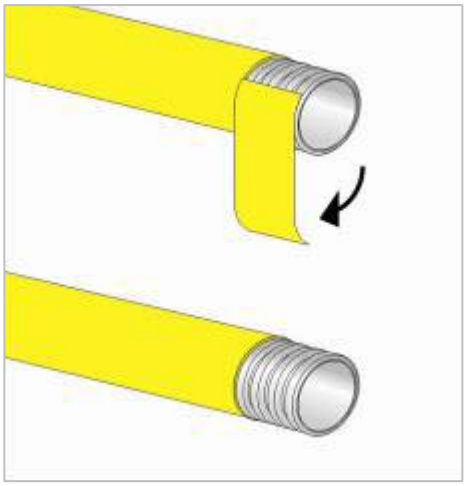
5.6 Cutting and fitting

The following is a step by step procedure for cutting BOAGAZ® CSSPT to length and fitting a connection.

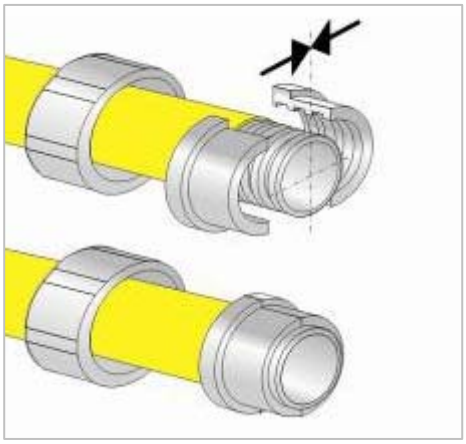
Step 1
Determine the proper length. Cut the BOAGAZ® tubing through the plastic cover and stainless steel to length with the BOAGAZ® tubing cutter. The cut must be centred between two corrugations. Swivel the cutter in one direction and tighten roller pressure slowly after each rotation. ***Attention: Overtightening may cause irregular cuts and deformation of the tubing.***



Step 2
Remove the cover with the BOAGAZ® stripper knife so that 4 corrugations are exposed to allow assembly of the fittings.
Caution: The stripper knife has a sharp blade, please handle with care.



Step 3
Slide nut over tubing and position the 2 retainer rings. Leave one corrugation exposed at the end of the tubing.



Step 4
Slide nut over retainer ring and hand-tighten nut using wrenches until it contacts the body. **Attention: Respect the maximum tightening torques.**

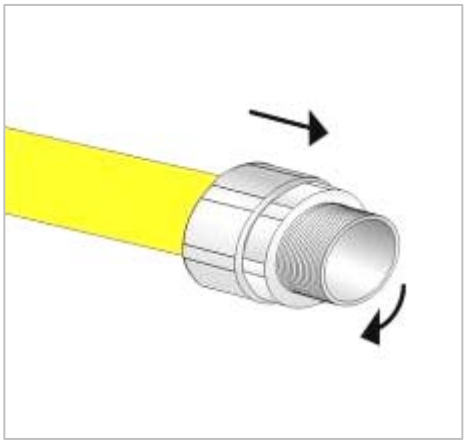


Figure 6: BOAGAZ® CSSPT cutting and fitting connections

5.7 BOAGAZ® Supports and support spacing

The BOAGAZ® tubes must not be hung from other pipework and nothing must be supported from BOAGAZ® tubing. It should be installed so that condensation or leaks from other pipes can not drip onto the BOAGAZ® tubing.

BOAGAZ® corrugated tubing can be installed in screed or plaster without cavities or in ducts and channels with adequate ventilation in accordance with BS6891:2005

Support points must be strong enough to support the weight of the tubing, fittings and clamps.

The following support spacing is recommended.

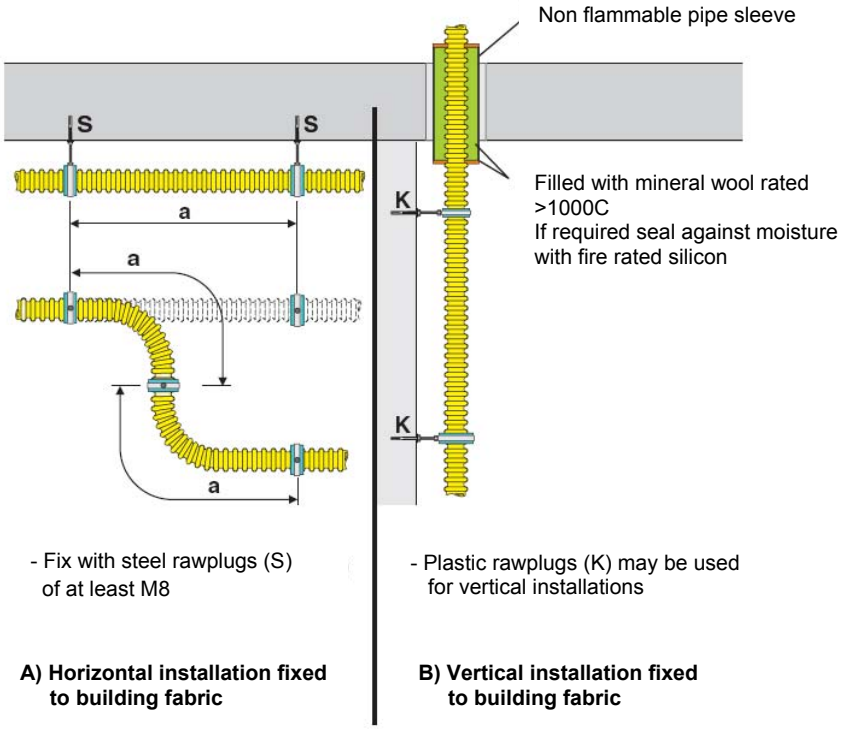


Figure 7: Supports and Support Spacing

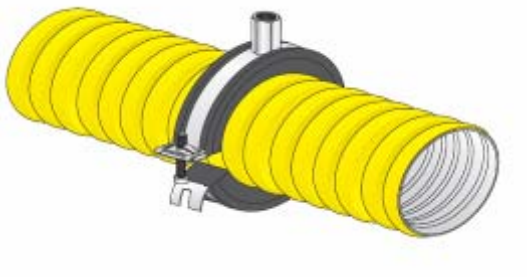
Dimension DN	Support Spacing m	
	horizontal	vertical
DN15	1.25 m	3 m
DN20	1.80 m	3 m
DN25	1.80 m	3 m
DN32	1.80 m	3 m

Table 17: Recommended Support Spacing

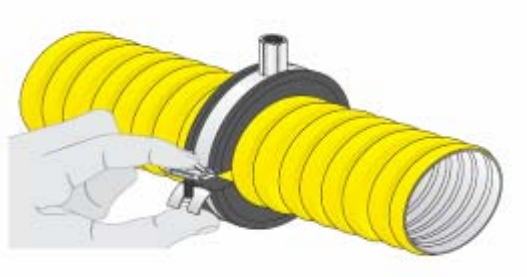
5.8 Supports

The BOAGAZ® tubing shall only be fixed with the BOAGAZ®/BISMAT® Flash pipe clamps which are part of the approved CSSPT system.

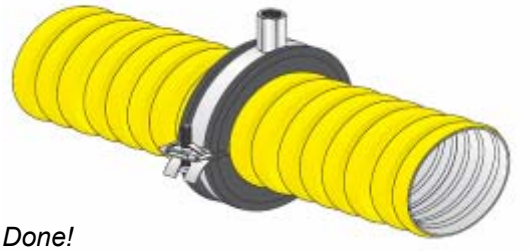
The BOAGAZ®/BISMAT® Flash is a single screw clamp with quick locking system. The locking screw can be secured by one single thumb push. Tools are not required.



Insert tubing



close clamp/push screw



Done!

Figure 8: Quick installation of the BOAGAZ®/BISMAT® Flash tubing clamps

The BOAGAZ®/BISMAT® Flash is suitable for fixing all BOAGAZ® tubing from DN15 to DN32.

The steel locking mechanism guarantees safety and reliability in all conditions. The fire resistance properties of the BOAGAZ®/BISMAT® Flash are tested by the Material Prüfungs Anstalt Braunschweig (Germany).

To guarantee optimum fire resistance use matching fire resistant threaded rods and rawplugs for fixing the tubing clamps to the building structure. We recommend the BIS Stud Bolts and the BIS Drop-in anchors and setting tools from Walraven (www.walraven.eu).

Fire resistance time	**Max. admissible load, kN**
F 0	≤ 0.55
F 30	≤ 0.10
F 60	≤ 0.07
F 90	≤ 0.05

Table 18: Fire resistance times for the BISMAT Flash M8/M10 tubing clamps in conjunction with threaded rods (dimensions ≥ M8 and M10, Strength Class 4.6) depending on maximum load

All values for the BOAGAZ®/BISMAT® Flash pipe clamps only apply in conjunction with threaded rods (dimensions ≥ M8 and M10, Strength Class 4.6) depending on maximum load.

For applications BOAGAZ®/BISMAT® Flash M8 / M10 pipe clamps in the space between ceilings and suspended ceiling structures that are relevant to fire safety, a minimum distance min. a is defined on the safe side between the top of the suspended ceiling and the bottom of the clips in order to prevent a negative impact on the suspended ceiling structure as a result of the temperature-related vertical clip deformations as well as changes in the length of the threaded rods. Here, the maximum suspension height of the clip components with the threaded rods must be limited for fire-safety reasons to $h_a \leq 1000$ mm insofar as no other proof is available. Table below states the minimum distances (min. a) for fire-resistance times of 30 to 90 minutes on the safe side. The values stated in this table take account of the temperature-related changes in length in the threaded rods used to suspend the ceiling and the maximum vertical deformations depending on the clamping range of the BOAGAZ®/BISMAT® Flash M8 / M10 clamps.

Clamping size range for the BISMAT® Flash M8 and M8 / M10 pipe clamps	**Minimum distances min. a. in mm for fire resistance times of 30 to 90 minutes**			
	Suspension height h_a			
[mm]	**≤250 [mm]**	**≤500 [mm]**	**≤750 [mm]**	**≤1000 [mm]**
15 - 18	40	43	47	50
20 - 23	41	44	48	52
25 – 28	42	46	49	53
32 – 35	43	47	50	54
40 – 43	44	48	52	55
48 - 51	46	49	53	56

Table 19: Minimum distances min. a in mm for application in the space between ceilings suspended with fire-safety relevant suspended ceiling structures depending on the' clamping size range as well as the suspension height $h_a \leq 1000$ mm

5.9 BOAGAZ® tubing system materials

BOAGAZ® CSSPT	- Stainless steel 1.4404
BOAGAZ® tubing protective cover	- PE
BOAGAZ® mechanical joint fittings	- Brass CW 603N or CW612N
BOAGAZ® gaskets in mechanical joint fittings	- Elastomer to EN 549

5.10 BOAGAZ® CSSPT in wooden joisted floors

5.10.1 Installation between floor joists or roof spaces

Where BOAGAZ® tubing is installed between floor joists or roof spaces, it shall be properly supported. BS 6891 specifies a maximum spacing between the BOAGAZ® pipe supports of 2.0m for a vertical run and 1.5m for a horizontal run for sizes up to 15 mm or DN15, and of 2.5m for a vertical run and 2.0m for a horizontal run for larger sizes.

5.10.2 Installation across joists in ceiling or roof spaces

Where BOAGAZ® tubing is laid across the joists in ceiling or roof spaces fitted with flooring it shall be located in purpose-made notches or possibly circular holes (see Figure 9).

Joists less than 100 mm shall not be notched.

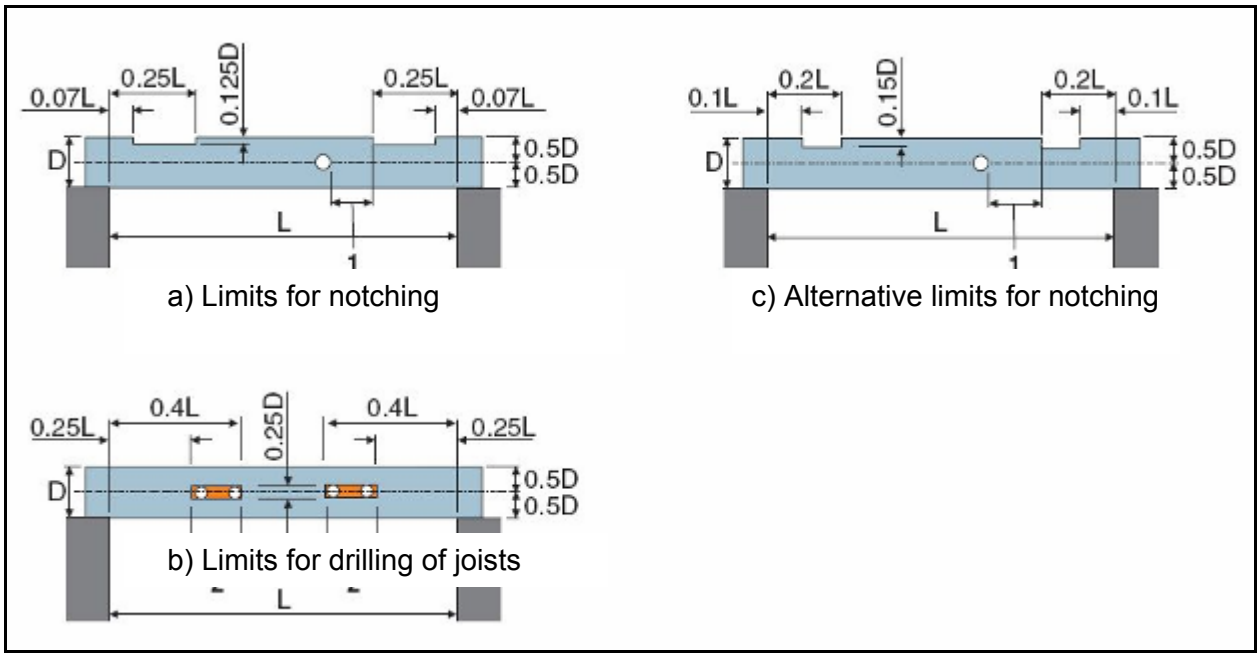
5.10.3 Installation in intermediate joisted floors

Where BOAGAZ® tubing is laid in intermediate joisted floors within dwellings, unless there is sufficient adventitious ventilation, ventilation shall be in accordance with Table 16 above (5.4.1).

For BOAGAZ® tubing supplying natural gas between floors, research has recently demonstrated there is no requirement to incorporate ventilation in intermediate floors within conventional masonry, timber or light steel frame buildings. Minor leakage of natural gas should be dispersed safely in these situations. However, as the research did not cover LPG leakage, tubing supplying LPG via intermediate floors shall be ventilated in accordance with Table 16.

Specialist joist systems constructed of wood that are similar in appearance to rolled steel joists are now used in properties which cannot be notched for structural reasons. However, such joists can either be drilled or are supplied with 'knock out' holes, which are pre-drilled. Where these joists are to be drilled, it is essential that the recommendations of the joist manufacturer are always followed.

BOAGAZ® tubing is particularly suitable for this system of joists as it can be threaded between joists with ease and so is compatible with this system. Before laying BOAGAZ® tubing below suspended floors a visual inspection should be carried out to note the position of any electrical cables, junction boxes and ancillary equipment, in order that accidental damage or injury does not occur when inserting BOAGAZ® tubing (see 4.1). Re-fixing flooring over BOAGAZ® tubing should also be done with care (see 4.1).



1 – Minimum 100mm between notch and hole
2 – Holes not closer than 3 x diameter

Figure 9: Limits for notches and drilling of solid timber floors

5.11 BOAGAZ®-tubing laid in concrete floors

5.11.1 General

BOAGAZ® CSSPT **may NOT be buried directly in concrete floors.** Tubing laid in concrete shall be installed in accordance with Figures 10-12 and shall be sleeved in accordance with 5.3.

Figures 10-12 illustrate how the BOAGAZ® tubing should be installed in:

- ground bearing concrete floors (Figure 10)
- a suspended concrete floor (Figure 11)
- a concrete raft (Figure 12)

After the BOAGAZ® tubing is laid and prior to pouring screed, the entire run of BOAGAZ® tubing must be examined visually and manually. The installer must closely inspect the cover in order to check whether damage to the coating has taken place as this could prejudice corrosion resistance.

Repair any cover damage by wrapping with tape.

5.11.2 Movement and settlement

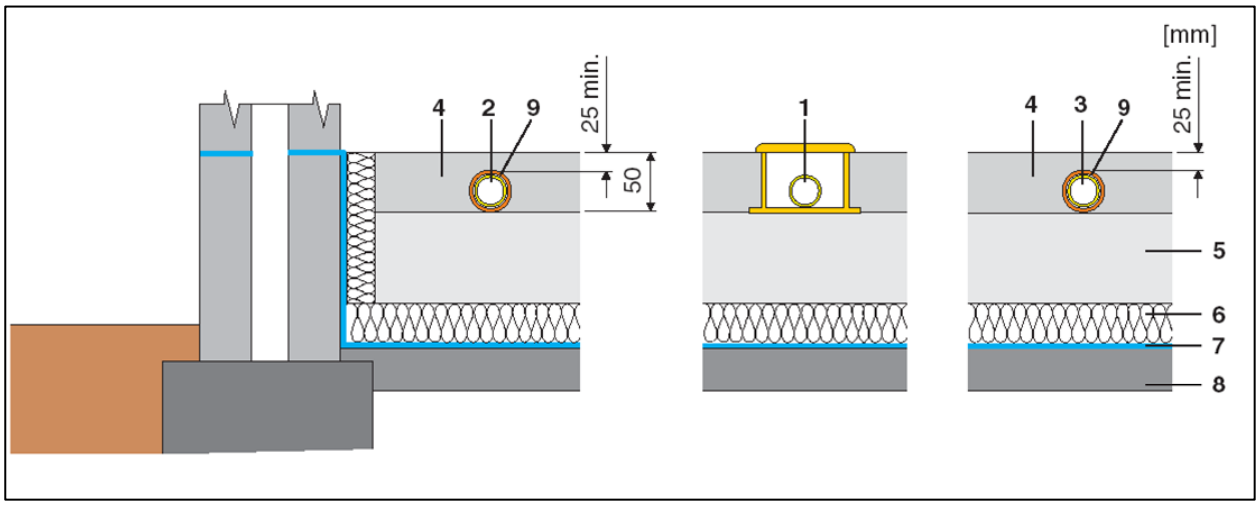
BOAGAZ® tubing laid in concrete floors shall be protected against failure caused by movement. BOAGAZ® tubing buried in concrete floors shall be suitably sleeved and protected against failure by (seismic) movement and settlement. Protection against failure can be afforded by laying BOAGAZ® tubing (sleeved) on top of base concrete and subsequently covering it with screed (see Figure 10) to a minimum depth of 25mm.

5.11.3 BOAGAZ® CSSPT passing through solid floors

Tubing passing vertically through solid floors shall take the shortest practicable route and shall be sleeved (see 5.3).

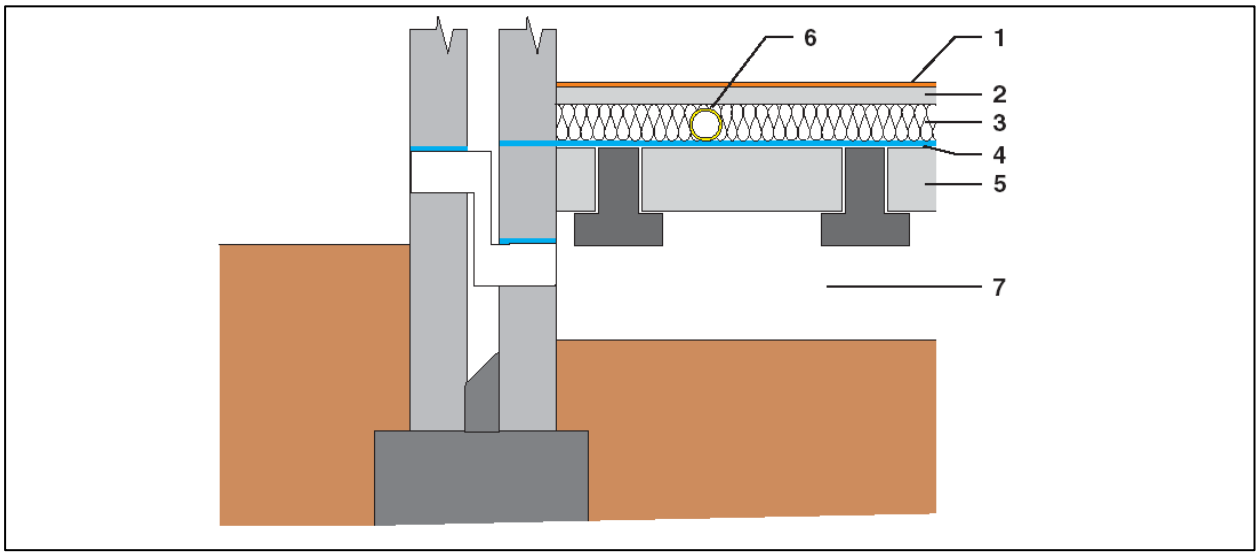
5.11.4 BOAGAZ® fittings

No BOAGAZ® fittings shall be buried in the structure or below ground. Boxes, with removable plywood covers and suitable for accessing BOAGAZ® fittings within floor screed are available from specialised building suppliers, described as ‘Conduit junction boxes’.



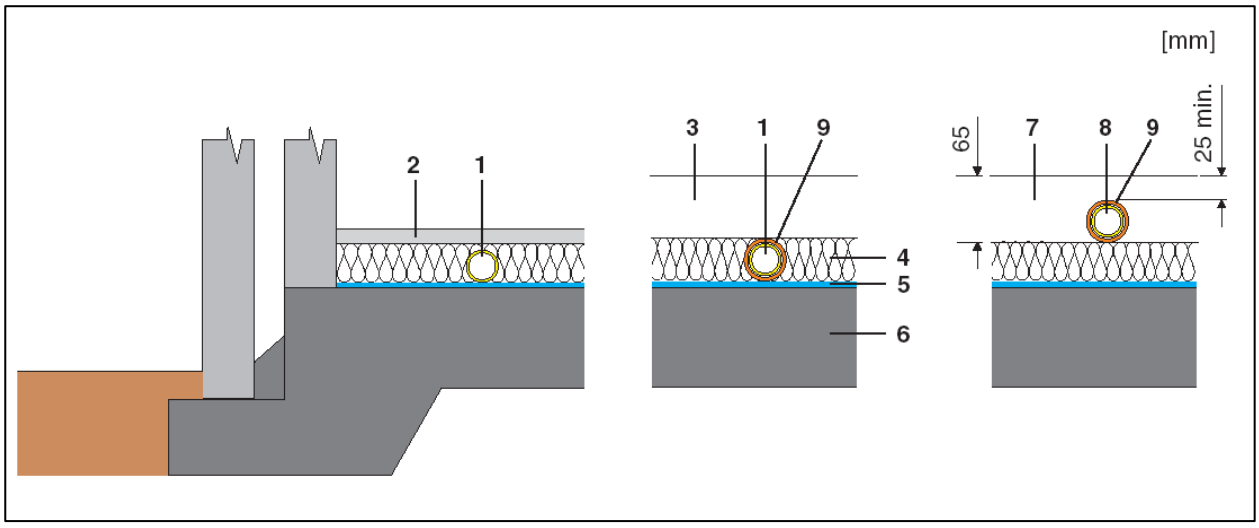
1 - BOAGAZ® tubing laid in preformed duct
2 - Corrosion protected BOAGAZ® tubing laid in screed
3 - BOAGAZ® tubing fitted with soft sleeving and laid in screed
4 - Screed
5 - Concrete slab
6 - Insulation
7 - Damp-proof membrane
8 - Hardcore and sand blinding
9 - Protection tubing

Figure 10: Ground bearing concrete floors



1 – Chipboard over insulation
2 – Chipboard
3 – Insulation
4 – Damp-proof membrane
5 – Precast beam and block
6 – BOAGAZ® tubing laid in insulation layer
7 – Ventilated void

Figure 11: Suspended concrete floor



1 – BOAGAZ® tubing laid in insulation layer
2 – Chipboard over insulation
3 – Screed over insulation
4 – Insulation
5 – Damp-proof membrane
6 – Concrete raft
7 – Reinforced concrete screed
8 – BOAGAZ® tubing laid in reinforced concrete screed
9 – Tubing protection

Figure 12: Concrete rafts

5.12 BOAGAZ® CSSPT in walls

Examples of BOAGAZ® tubing in masonry and timber frame walls are presented in Figures 13 -16.

These illustrate installation into walls that are:-

- brick and block plastered (Figure 13)
- brick and block with dry lining on dabs (Figure 14)
- brick and block dry lined on battens (Figure 15)
- timber frame construction (see Figure 16)

5.12.1 Tubing runs

BOAGAZ® tubing shall, wherever possible, be mounted vertically in ducts within which there are suitably located access points or else positioned in tubing chases. Tubing shall be secured to minimise movement and have as few joints as practicable.

5.12.2 Cavity walls

BOAGAZ® tubing shall not be positioned within the cavities of cavity walls. When tubing passes through such walls, they must be sleeved and take the shortest practicable route.

5.12.3 Dry lined walls

When installing BOAGAZ® tubing behind dry lining, tubing shall be encased by building material.

5.12.4 Timber construction walls

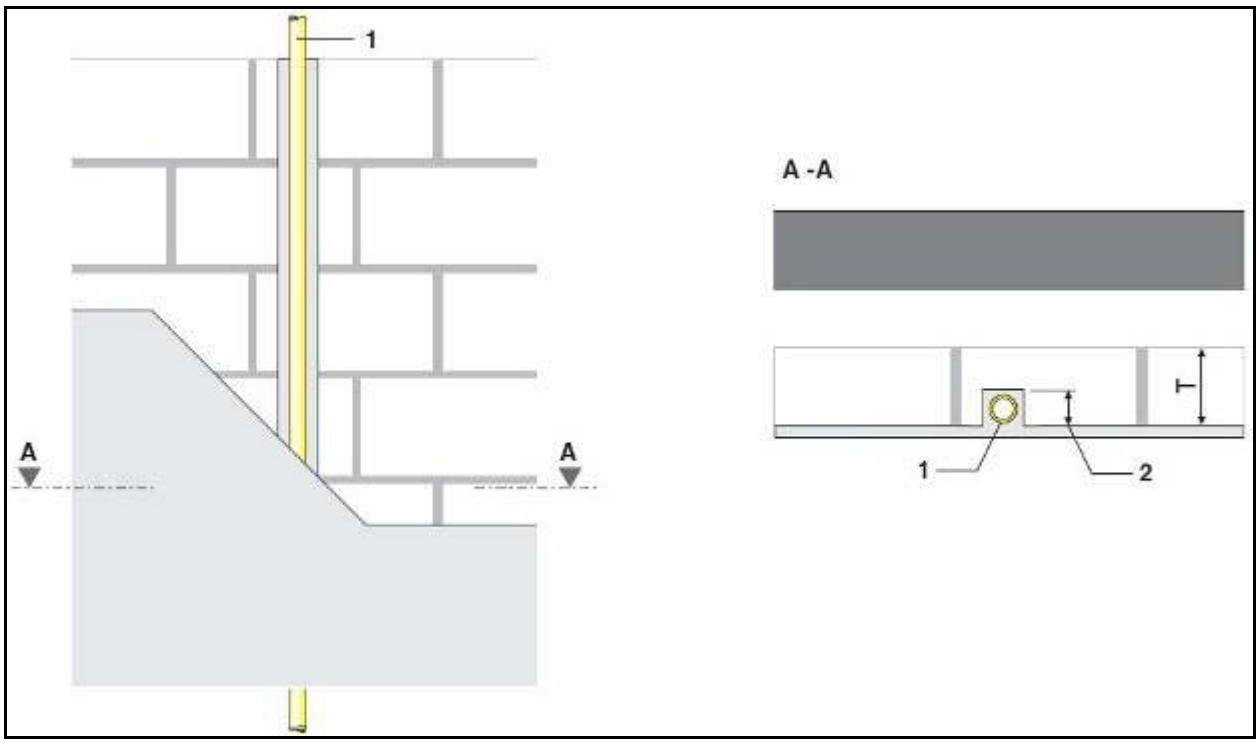
For BOAGAZ® tubing installed within the walls of timber-frame buildings, the tubing shall be:

a) run within channels or ducts that are purpose-designed
b) adequately secured
c) protected against mechanical damage within any void space
d) suitably protected against corrosion

5.12.5 Solid Walls

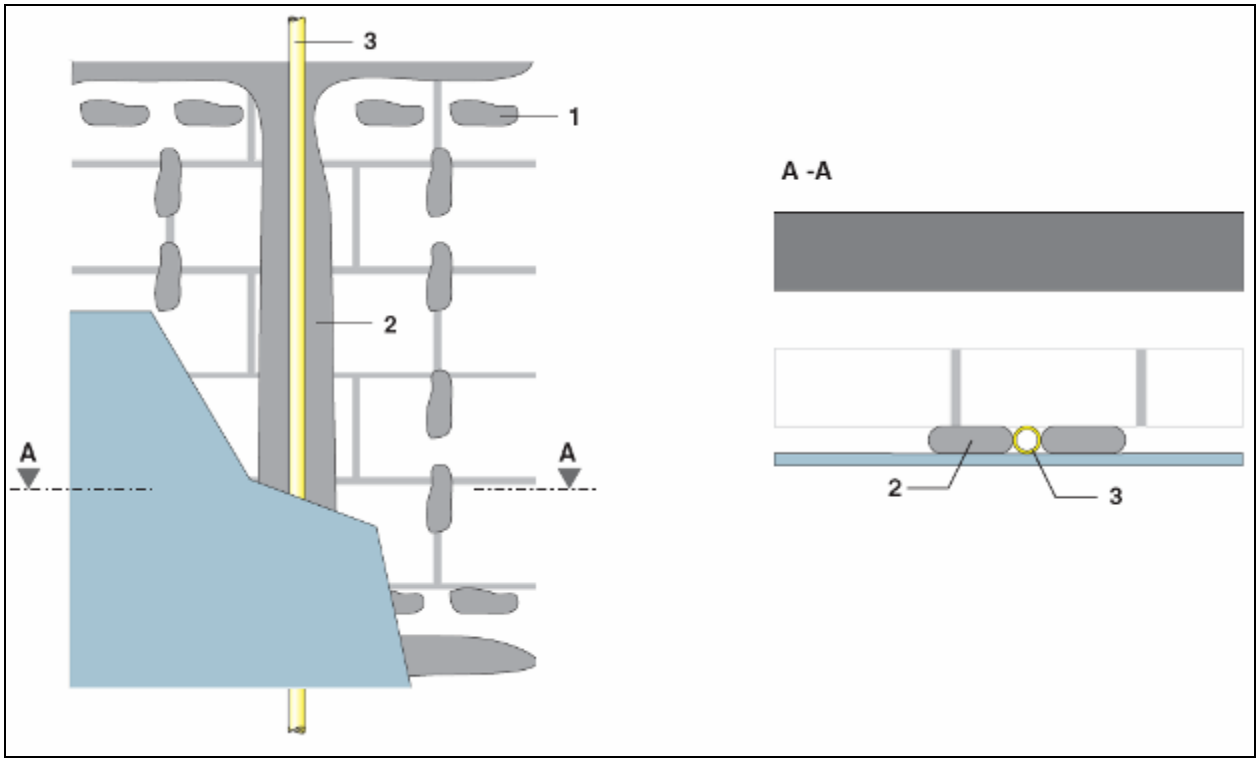
All BOAGAZ® tubing shall be sleeved (see 5.3).

BOAGAZ® tubing should be secured at each floor, but will be free to move away from potential puncture threats behind plasterboard and other wall surfaces.



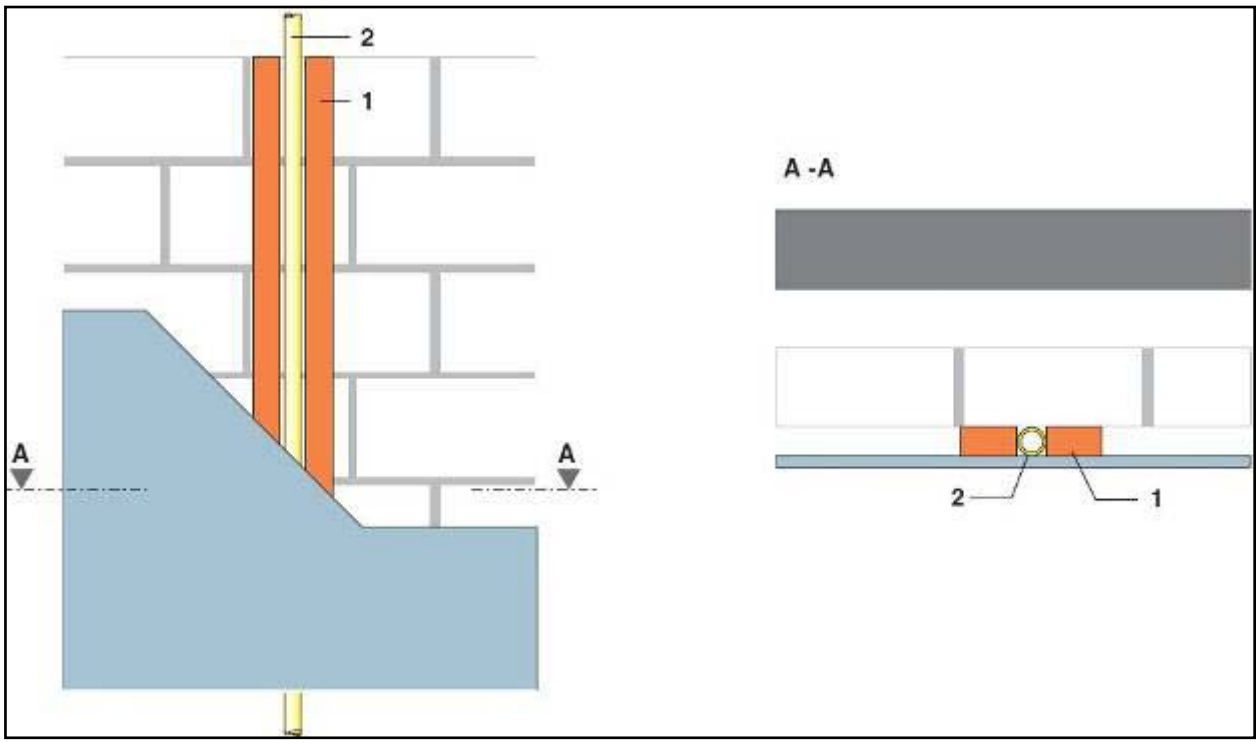
1 – Gas tubing set in chase	3 – Gas tubing set in chase in plastered wall
2 – Chase depth	Maximum depth of chase T/6 horizontal; T/3 vertical

Figure 13: Brick and block plastered wall



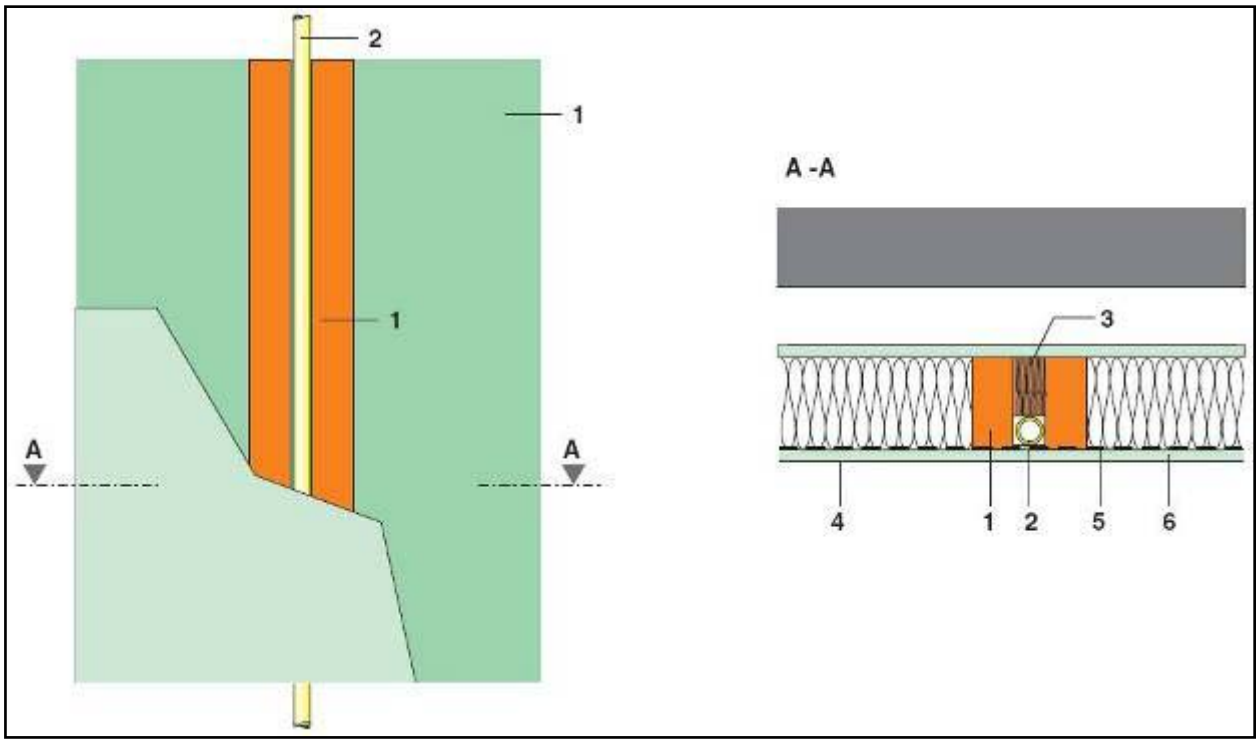
1 – Individual adhesive dabs	3 – Gas tubing
2 – Continuous adhesive dabs to surround tubing	

Figure 14: Brick and block with dry lining on dabs



1 – Timber battens	2 – BOAGAZ® tubing

Figure 15: Brick and block dry lined on battens



1 – Timber stud	4 – Plasterboard
2 – BOAGAZ® tubing	5 – Metallic protection
3 – Blocking piece	6 – Vapour control barrier

Figure 16: Timber frame construction

5.13 Exterior tubing

The BOAGAZ® system can be installed outside when it is adequately protected against adverse weather conditions and mechanical damage.

5.14 Connection and disconnection of BOAGAZ® CSSPT and fittings

Where any BOAGAZ® installation tubing is no longer required, the tubing shall be disconnected as close to the point of supply as practicable. All tubing ends shall be sealed, e.g. with a plug or cap.

During any work that necessitates connection or disconnection of any installed BOAGAZ® tubing, a temporary continuity bond shall be fixed where production of a spark or shock could cause a hazard, whether or not permanent equipotential bonding has been established.

The recommended disconnection procedure is as follows.

a) Isolate the electrical connection of associated gas appliances from the main supply.
b) Clip or clamp a temporary continuity bond to each side of the union, fittings or complete section that is to be removed or connected ensuring that sound metallic contact is made.
c) Leave the bond in position until after the work is completed and metallic continuity re-established.

A recommended temporary continuity bond comprises of at least 1.2 m of single-core insulated flexible cable or equivalent of at least 250 V rating. The cable should have a cross-sectional area of not less than 10 mm^2 and multi-strand flexible construction BS 6007 or BS 6231 with a robust clip or clamp firmly attached at each end.

Where the meter is removed BS 6400 should be consulted

6 Prevention of corrosion or degradation of BOAGAZ® CSSPT

BOAGAZ® system components shall not be exposed to any acids, bases, salts or other caustic materials. Some chemical compounds have been identified that may aggressively corrode 1.4404 stainless steel. Contact with these chemicals should be absolutely avoided. Any contact should be immediately and thoroughly washed off. The plastic covering is not affected by these compounds and will protect the tubing as long as it is undamaged.

Chemicals to avoid include the following:

- Hydrochloric Acid (common name: muriatic or brick wash)
- Zinc Chloride and Ammonium Chloride (soldering flux, pool algaecide)
- Calcium or Sodium Hypochlorite (bleach or pool chemicals)
- Copper Chloride (may be found in fungicides or wood preservatives)
- Ferric Chloride (swimming pool flocculent)
- Phosphoric Acid (scale removers)
- Sodium Chloride (salt water)
- Sulphuric Acid (battery acid)

Leak detection with chloride-containing compounds found in some common soap (e.g., dishwashing soap) can corrode BOAGAZ® CSSPT. Avoid use of these compounds in connection with BOAGAZ®.

Any leak detection solution coming in contact with the BOAGAZ® system should have a sulphur, chlorine and halogen content of less than 10 ppm of each.

7 Gas tightness testing and purging

An assembled BOAGAZ® gas supply installation shall be tested for gas tightness and purged in compliance with IGE/UP/1B.

7.1 New installations

When new BOAGAZ® tubing is installed in a property it has to be tightness tested using natural gas, propane or butane as appropriate once the connection to a gas supply has taken place. If such a gas supply connection has not been made, then pressurised air should be used.

A visual inspection of joints should be made to ensure they have been correctly made and a check should then be made to confirm there are no open ends on the tubing system.

Following this, the procedure in IGE/UP/1B should be followed.

7.2 Existing installations

Here, gas tightness should be checked using natural gas, propane or butane as provided by the connected gas supply.

The gas tightness testing should be carried out as per IGE/UP/1B depending upon whether the maximum operating pressure is less than 75mbar or greater than 75mbar and with a test valve fitted to the installation tubing system.

7.3 Purging

IGE/UP/1B requires that whenever a gas supply system is commissioned or re-commissioned after being turned off, any air in the system must be purged.

First, the system should pass a satisfactory tightness test (as indicated in 7.1 and 7.2 above).

8 Damage and Repair

If the BOAGAZ® tubing is damaged, determine the extent of the damage and the method of repair.

8.1 Small visible damages to the cover

Damage to the cover can lead to corrosion of the BOAGAZ® tubing. Repair any damage of the cover by wrapping with tape.

8.2 Damage of tubing

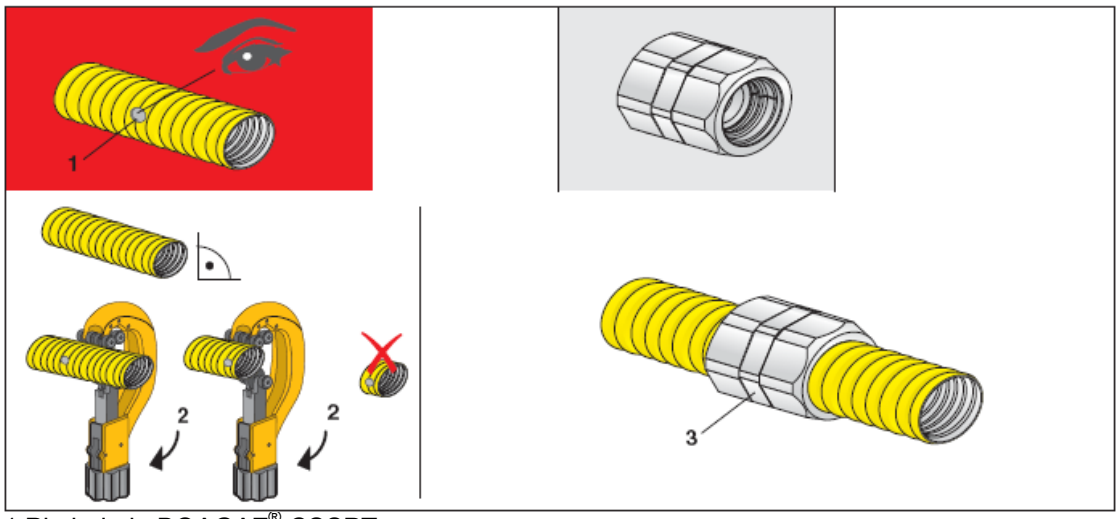
The tubing must be replaced in the following cases:

a) The tubing has been excessively bent below the minimum bend radius so that the internal cross section has been deformed in shape.
b) The tubing has been punctured by nails or other sharp objects.
c) The tubing has been significantly crushed.

- **Replace the entire tubing run.** In most cases, when the tubing run is short and easily accessible, it can be replaced faster and more economically than repairing the damaged section. This is the preferred method because extra fittings are not required.

- **Repair the damaged section.** The damaged tubing can be repaired by each of the following two methods.

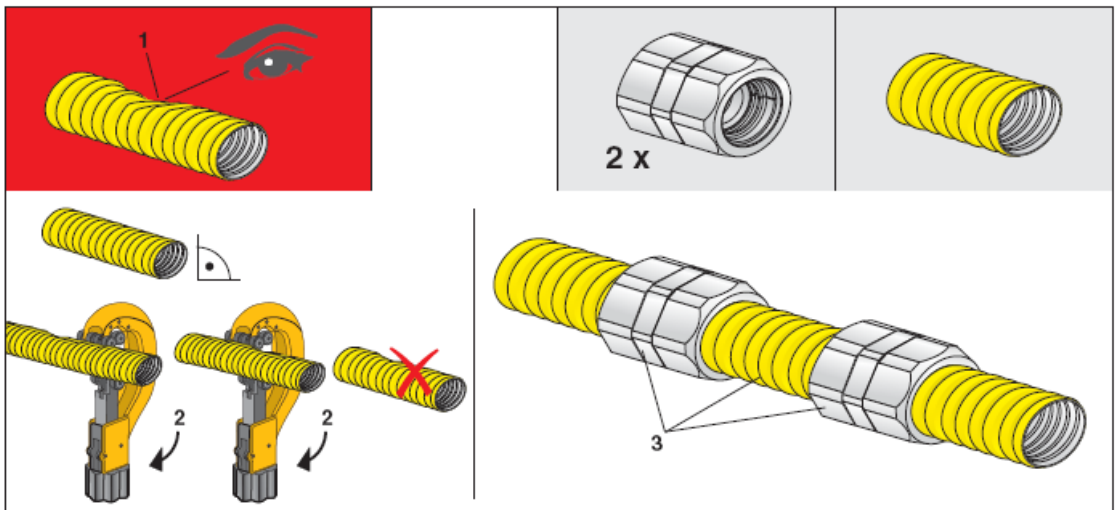
Method 1: Remove the section of tubing which is damaged and reconnect the new ends with a single mechanical coupling. Use this repair method if the damaged section is between 2 corrugations and if there is enough excess tubing in the run to make-up for the removed damaged length.



1 Pin hole in BOAGAZ® CSSPT
2 Cut out damaged section
3 Re-connect with BOAGAZ® coupling as per Instructions

Figure 17: Repair of minor damage

Method 2: Remove the section of tubing which is damaged and splice in a new section of tubing with two mechanical couplings. Use this repair method if the extent of the damage covers more than a small area, and there is not enough slack in the existing tubing run to make-up the damaged length.



1 Major damage to BOAGAZ® CSSPT
2 Cut out damaged section
3 Splice in new tube section with two BOAGAZ® coupling as per Instructions

Figure 18: Repair of major damage

8.3. Connection to other systems

BOAGAZ® tubing may only be connected to other piping materials using approved screwed fittings. Copper pipe systems must be thoroughly cleaned and free from any solder flux residues before connecting BOAGAZ® tubing.

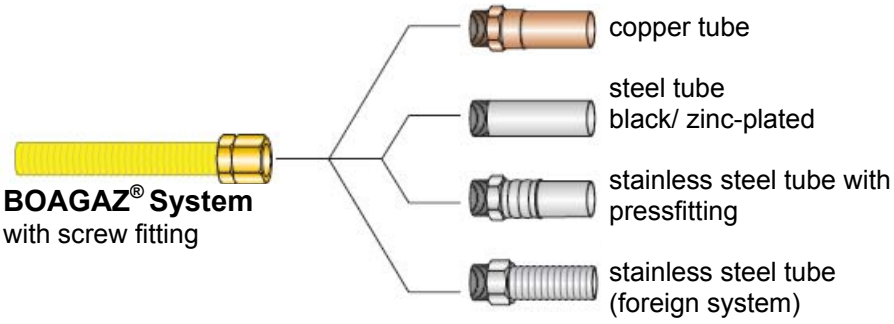


Figure 19: Connection to other gas piping systems or fittings

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